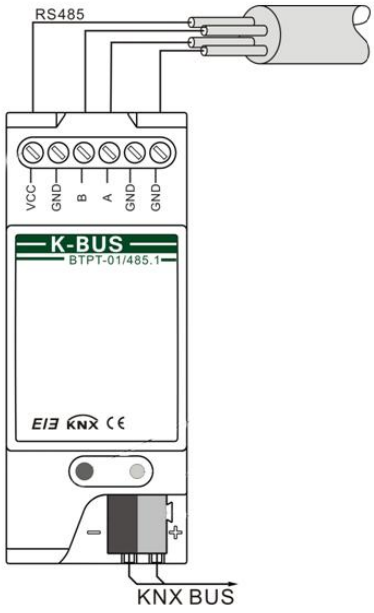
K-BUS®RS485/ KNX Converter

User manual-Ver.1

BTPT-01/485.1

KNX/EIB Intelligent Installation Systems



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1. Summary

The RS485/ KNX converter is designed for intelligent building control system. It has built-in 2000V ESD protection. The RS485/ KNX converter can transfer two-way signals, but only RS485 devices can control the KNX/EIB devices with current version of our open control protocol.

No standardized higher layer protocol for RS485 bus, we define one in the chapter 4 of this manual for RS485 devices to control KNX/EIB devices. The users can configure or program the RS485 devices according to the protocol to achieve the control. The RS485/ KNX converter has two working modes: the monitor mode and the filter mode. In the case of the monitor mode, all active telegrams can be forwarded. In the filter mode, only the telegrams those with a group address in the filter table in the RS485/ KNX converter will be forwarded to the other side. The filter table can be set via the filter table setting command from RS485 bus system.

The functions of the RS485/ KNX are summarized as follows:

- Open communication protocols for the RS485 interface
- To receive and transfer the telegram in defined format.
- Converting the telegram from the RS485 bus to the KNX/EIB telegram, and sending to the KNX/EIB system, to control the KNX devices.
- ACK report and executed result report.
- Support bus monitor and filter functions (the filter table can be configured or programmed. The Max. Number of group address is 254 in the table.)
- The baud rate of the convertor can be programmed
- To read and write any data type defined in the KNX standard (Max. 14 bytes)

This manual provides technical information as well as assembly and programming in detail about the RS485/KNX Converter for users, and explains how to use the converter by the application examples.

The RS485/KNX Converter is a modular installation device. It can be installed in the distribution board on 35 mm mounting rails according to EN 60 715. The device adopts screw terminal to achieve the RS485 bus connection, the power supply for RS485 interface is provided by RS485 system. The RS485/KNX Converter is connected to the KNX/EIB system using EIB bus connection terminals, and no need any extra voltage supply.

The RS485/KNX Converter is able to use the Engineering Tool Software ETS (ETS3 or later) with a VD4 file to allocate the physical address and set the parameters.

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2. Technical Properties & Dimension and Circuit Diagram

2.1 Technical data

Power supply	Operating voltage	21-30V DC，via the EIB bus
	Current input, EIB	<12mA
	Power consumption, EIB	<360mW
RS485 interface	VCC（DC）	9V<VCC<40V(recommend DC12V/24V)
	Power consumption	42mW(12V),75mW(24V)
	Max. power consumption	120mW(12V),144mW(24V)
Outputs	Number of outputs	1channel
Connections	EIB / KNX	Bus connecting terminal (black/red)
	RS485	1 screw terminal for VCC, 2 screw terminals for A and B bus, 3 screw terminals for GND
	Wire range	Single-core 0.2—6.0mm^2
		Multi-core 0.2—4mm^2
Operating and display elements	Red LED and push button	For assignment of the physical address
	Green LED flashing	Indicate the device running normally(OK)
Temperature range	Operation	–5 ℃ ... + 45 ℃
	Storage	–25 ℃ ... + 55 ℃
	Transport	– 25 ℃ ... + 70 ℃
Ambient condition	Humidity	<93%, except dewing
Design	Modular installation device，on 35 mm Din rail	
Interface protection	Built-in 2000V ESD protection	
Baud rate	4800~115200 bps	
Transmission range	< 1 km	
Transmitting media	Twisted pair or shielded wire	
Working mode	Asynchronous half-duplex differential transmission	
Dimensions	90×36×64mm（H×W×D）	

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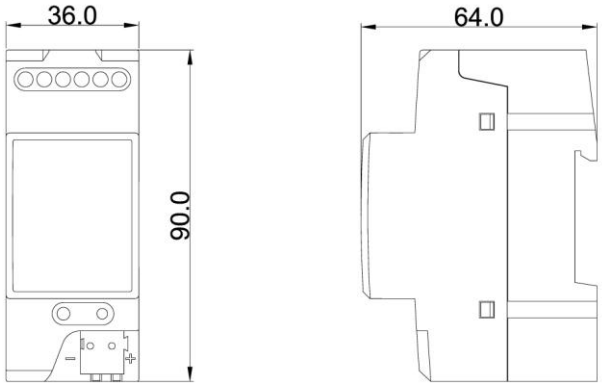
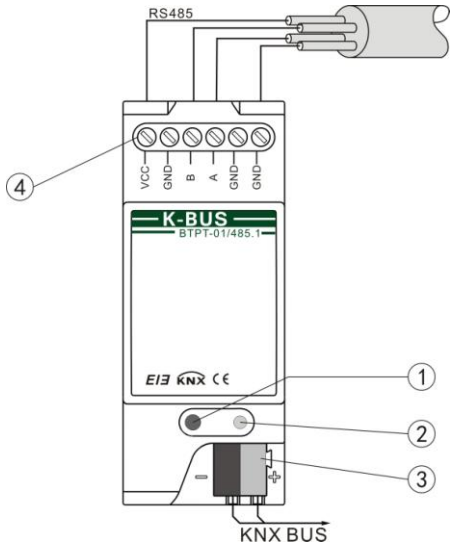
Weight 0.1kg

Application program	Max. number of communication objects	Max. number of group addresses	Max. number of associations addresses
RS485/KNX converter	0	0	0

2.2 Dimension diagram



2.3 Circuit diagram



① Programming button

② Programming LED, red LED for assigning the physical address, green LED for indicating the application

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layer works normally

③ KNX / EIB bus connection terminal

④ RS485 bus connection terminal

3. Project design and programming

3.1 Overview of the functions

- **Open communication protocols**

The communication protocols for RS485 interface is open, anyone can follow the text of the protocols to achieve communication between devices on different bus. So you can easily connect the KNX/EIB bus system with other 485 bus system into a whole, but also to ensure the reliability, commonality and scalability of the system internal real-time communication, and thus really to realize openness of the system.

- **For receiving and sending communication control telegram**

The communication control telegrams are received and sent in accordance with the preformatted. The formats of the telegrams are described in the next chapter "communication protocol", i.e. command format. Each data in these command represent different meaning, seeing the table in the next chapter.

- **For converting the telegram**

The telegram which is generated in strict accordance with the communication protocol format is received from the RS485 bus by the RS485/KNX converter. While receives the telegram from the RS485 interface, the RS485/KNX converter extract the EIB information from the telegram, such as the group address, length, data type and value, etc, and then converted them into the KNX/EIB telegram, and sent to the KNX/EIB system to control the KNX devices.

- **ACK report and executed result report**

When receives a telegram from the RS485 bus, the RS485/KNX converter will check the CRC in the telegram first. If the telegram is correct, the RS485/KNX converter will respond to the RS485 bus via sending an ACK report. If the telegram is not correct, it will not respond. When the telegram is successfully transmitted to the EIB bus, the RS485/KNX converter will send a successful telegram to the RS485 bus. If not successfully transmitted, it will send a fail telegram to the RS485 bus (see also "RESULTPKT" telegram).

- **Bus monitor and filter functions**

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The RS485 bus system can monitor the data on the EIB bus via the RS485/KNX converter. The RS485/KNX converter also provides filter function to group address. When the filter function is set, the RS485/KNX converter only forwards the telegram which group address in the filter table to the EIB bus or the RS485 bus. The filter table can be modified or set by the RS485 device. The Max. Number of group address in the filter table is 254. General, the bus monitor mode is suitable for most of the users.

- **The baud rate is programmable**

The baud rate refers to the binary data bits that are transmitted per second on the RS485 bus. Different devices have different baud rate. The baud rate of the RS485/KNX convertor can be set to the same with the devices on the RS485 bus via the parameter.

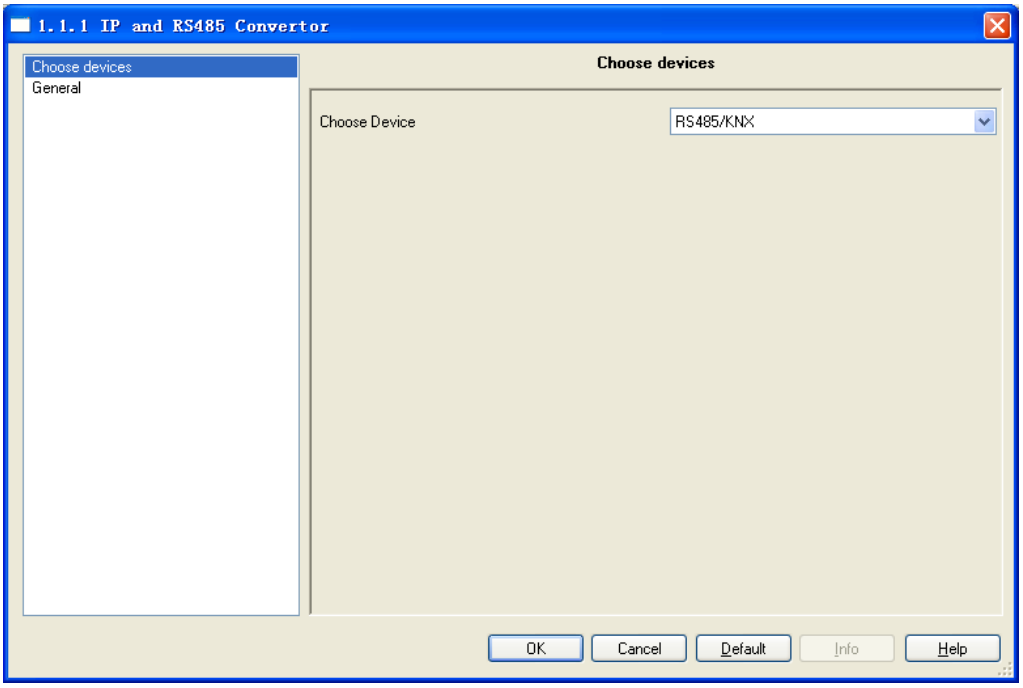
- **Reading and writing data type**

The data telegram that length is less than or equal to14bytes can be sent to or read from the EIB bus via the RS485/KNX converter.

3.2 Parameter setting description in the ETS

Parameter window is shown below. Here can set some parameters about RS485/KNX converter, such as machine ID, the baud rate, stop bits and parity, etc.

Because IP converter and RS485 converter use the same product database, so before setting RS485 parameters, you must select devices first, as follow:



Choose device

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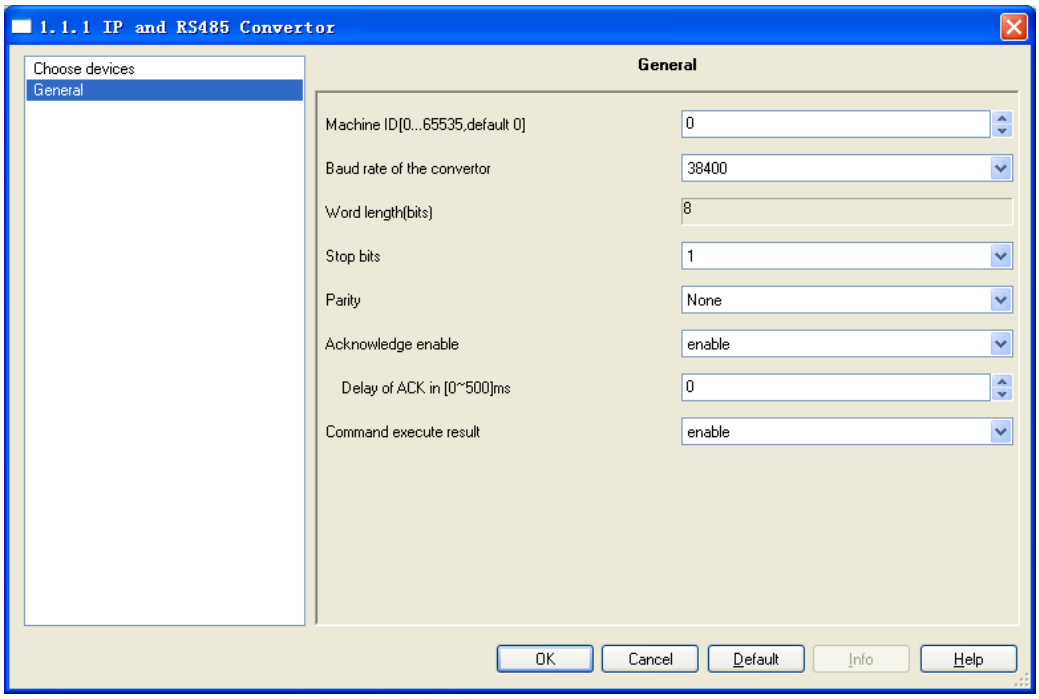

RS485 parameter window

Parameter "Machine ID [0…255，default 0]"

Here set the machine ID of the RS485/KNX converter. The ID is a unique identifier for naming the device throughout a RS485 installation while the physical address is also a unique identifier for naming the device throughout an EIB installation. The machine ID option is 0~255.

Parameter "Baud rate of the convertor"

This parameter is used to set the baud rate of the RS485/KNX convertor. The baud rate can be set to the same with the devices on the RS485 bus. Options: 4800/9600/14400/19200/38400/56000/57600/115200

Parameter "Word length (bits)"

This parameter defines word length of data transmission as 8bits. A value can be sent from 0 to 255.

Parameter "Stop bits"

This parameter defines stop bits of data transmission. Options: 0.5/1/1.5/2

Parameter "Parity"

This parameter defines parity of data transmission. Options: None/Odd/Even

Parameter "Acknowledge enable"

This parameter defines whether sends an ACK report to the RS485 bus when a RS485 telegram is received successfully by the RS485/KNX converter. Option: Enable/Disable

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Parameter "Delay of ACK in [0…500] ms"

This parameter is visible in the parameter "Acknowledge enable" with "enable", which is used to set the delay time when the converter sends an ACK report. When the delay time has elapsed, the ACK report is sent. Option: 0…500 ms

Parameter "Command execute result"

This parameter defines whether sends an executed result report to the RS485 bus when a RS485 telegram is transmitted successfully to the EIB bus via the RS485/KNX converter. Option: Enable/Disable

4. Communication Protocols

4.1 Default Communication Parameters

Baud rate of the RS485/KNX convertor: 38400, Parity: None, Word length (bits):8, Stop bits: 1, this means that the device does not need to configure via ETS and can be used directly after leave factory.

Command packet：

```
typedef struct {
    BYTE    Head1;          // Always is 0x55=STX1.
    BYTE    Head2;          // Always is 0xAA=STX2.
    WORD    MachineID;      // terminal's ID.
    WORD    Reserved;  // Reserved
    WORD    Command; // Command ID
    DWORD   Length;    // Input Parameter 1
    WORD    InParam;   // Input Parameter 2
    WORD    ChkSum;    // Checksum
} CMDPKT;                   // Size of command packet is 16 Bytes.
```

Command acknowledge packet：

```
typedef struct {
    BYTE    Head1;          // Always is 0x5A=STX1.
    BYTE    Head2;          // Always is 0xA5=STX2.
    WORD    MachineID;      // terminal's ID.
    WORD    Response;  // 0x00-NAK, 0x01-ACK.
    WORD    ChkSum;    // Checksum
} ACKPKT;                   // Size of command acknowledge packet is 8 Bytes.
```

Command execution result packet：

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```
typedef struct {
    BYTE    Head1;          // Always is 0xAA=STX1.
    BYTE    Head2;          // Always is 0x55=STX2.
    WORD    MachineID;      // terminal's ID.
    WORD    Reserved;   // Reserved
    WORD    Ret;        // 1: OK 0: Error
    DWORD   OutParam;   // Output Parameter
    WORD    ChkSum;     // Checksum
} RESULTPKT;                    // Size of command execution result packet is 14 Bytes.
```

Instruction：

1、 If the Machine ID in the packet received from RS485 system is the same in the RS485/KNX converter and the packet is checked correctly, the RS485/KNX converter will send ACK to the RS485 interface. The received command should be used the format of CMDPKT while the ACK should be used the format of ACKPKT.

2、 After the command was executed, the RS485/KNX convertor will report the execute result using the format of structure RESULTPKT.

3、 When write a Group Address which has more than 2 bytes Object Value, the Object Value should be send to the RS485/KNX Convertor via Setting Data Command after the command is executed completely. Having received a whole Setting Data Command, the RS485/KNX convertor will convert the Command to EIB/KNX bus, and after transmit successfully, it will report the execute result using the format of structure RESULTPKT to the RS485 interface. The format of the command could be also seen in the table located in chapter 4.4.

4、 When read a Group Address, ensure that the Communication Object has the read/write/transmit enable. All the responds will be sent to RS485 interface using Data Respond Command, having a header of 0Xa5-0x5A.

4.2 Command ID

```
enum // The command ID for the connection.
{
    CMD_SET_MONITOR_MODE = 0x101,
    CMD_SET_FILTER_MODE,
    CMD_SET_RANDOM_MODE,    //The his command haven't defined temporary
    CMD_GROUP_ADDR_READ,
    CMD_GROUP_ADDR_WRITE
};
```

4.3 Read Group Address

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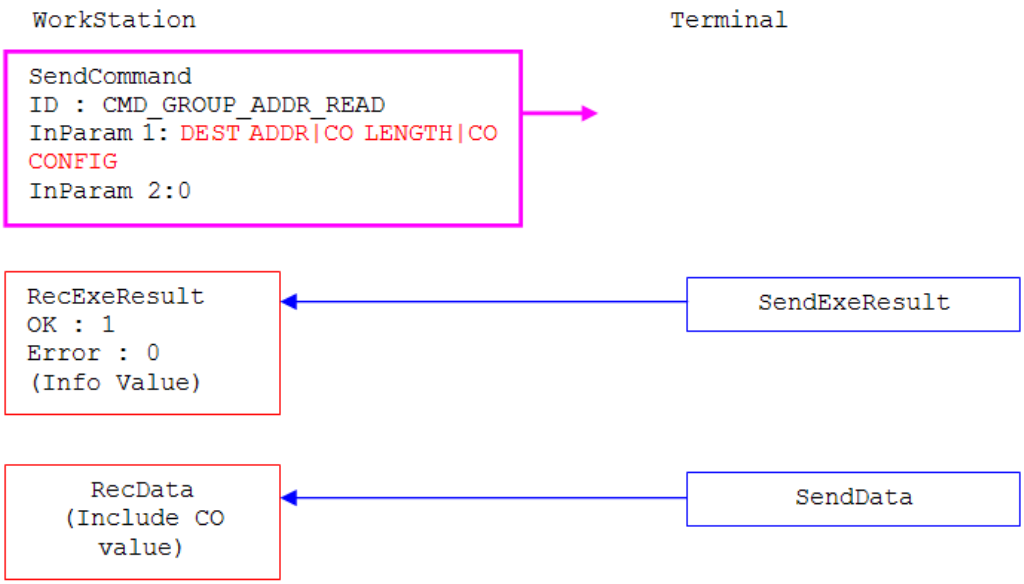

Protocol:

COMMAND(PC----Convertor)		
Byte	Value	Meaning
1	0x55	Always is 0x55
2	0xAA	Always is 0xAA
3 4	1--255, 0 = default	Machine ID
5 6	0	Reserved
7 8	CMD_GROUP_ADDR_READ	Command ID
9	nConfig(NOTE 1)(We used the lowest 2 bits as the priority, usually it equals 0x03)	Input Parameter 1
10	nLength(NOTE 2)	
11 12	DEST ADDR(NOTE 3)	
13 14	0	Input Parameter 2
15 16	ChkSum	Checksum(NOTE 4)
ACK(Convertor ---- PC)		
Byte	Value	Meaning
1	0x5A	Always is 0x5A
2	0xA5	Always is 0xA5
3 4	1--255, 0 = default	Machine ID

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5 6	0x00-NAK 0x01-ACK.	Response
7 8	ChkSum	Checksum(NOTE 4)
EXERESULT (Controller ---- PC)		
Byte	Value	Meaning
1	0xAA	Always is 0xAA
2	0x55	Always is 0x55
3 4	1--255, 0 = default	Machine ID
5 6	0	Reserved
7 8	1: OK 0: Error	Result
9 10 11 12	0	Output Parameter
13 14	ChkSum	Checksum(NOTE 4)
Data respond(Convertor----PC)		
Byte	Value	Meaning
1	0xA5	Always is 0xA5
2	0x5A	Always is 0x5A
3 4	1--255, 0 = default	Machine ID
5 6	SRC ADDR(NOTE 5)	Source Address
7 8	DEST ADDR(NOTE 3)	Destination Address
9	nLength	Length of the Group Address
10 11	// Group communication Multicast APCI_VALUE_READ 0x0000 APCI_VALUE_RESP 0x0040 APCI_VALUE_WRITE 0x0080	APCI of EIB telegram
		1~14 Bytes of Value
19 20	ChkSum	Checksum(NOTE 4)

4.4 Write Group Address

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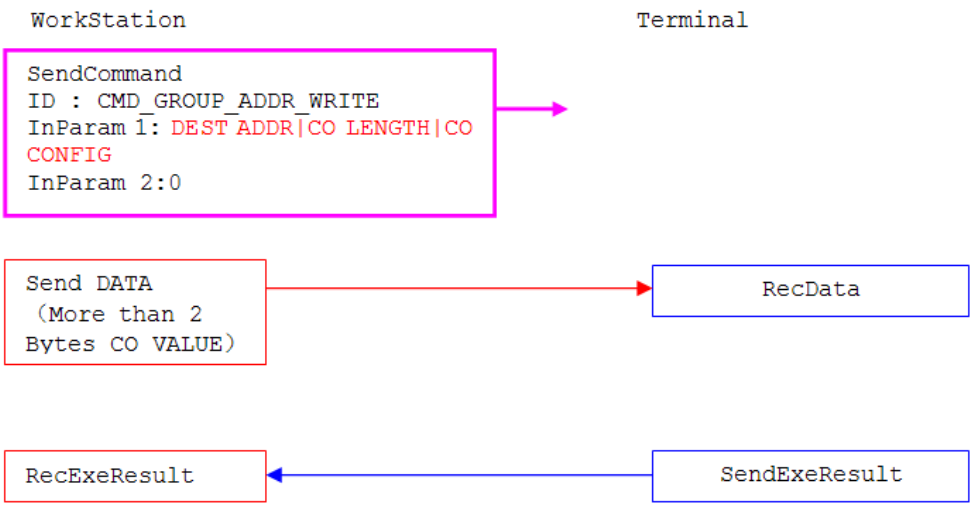

Protocol:

COMMAND(External----Convertor)		
Byte	**Value**	**Meaning**
1	0x55	Always is 0x55
2	0xAA	Always is 0xAA
3 4	1--255, 0 = default	Machine ID
5 6	0	Reserved
7 8	CMD_GROUP_ADDR_WRITE	Command ID
9	nConfig(NOTE 1) (We used the lowest 2 bits as the priority, usually it equals 0x03)	Input Parameter 1
10	nLength(NOTE 2)	
11 12	DEST ADDR(NOTE 3)	
13 14	(nLength <= 2) : Group Value Else : 0	Input Parameter 2
15 16	ChkSum	Checksum(NOTE 4)
ACK(Convertor ---- External)		
Byte	**Value**	**Meaning**
1	0x5A	Always is 0x5A
2	0xA5	Always is 0xA5
3 4	1--255, 0 = default	Machine ID
5 6	0x00-NAK 0x01-ACK.	Response

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7 8	ChkSum	Checksum(NOTE 4)
EXERESULT (Convertor ---- External)		
Byte	**Value**	**Meaning**
1	0xAA	Always is 0xAA
2	0x55	Always is 0x55
3 4	1--255, 0 = default	Machine ID
5 6	0	Reserved
7 8	1: OK 0: Error	Result
9 10 11 12	0	Output Parameter
13 14	ChkSum	Checksum(NOTE 4)
Setting Data(External ----Convertor)		
Byte	**Value**	**Meaning**
1	0x5A	Always is 0x5A
2	0xA5	Always is 0xA5
3 4	1--255, 0 = default	Machine ID
5		3~14 Bytes of Value(nLength >= 3) : Group Value
6~ 17		
18		
19 20	ChkSum	Checksum(NOTE 4)

4.5 Change the Monitor Mode

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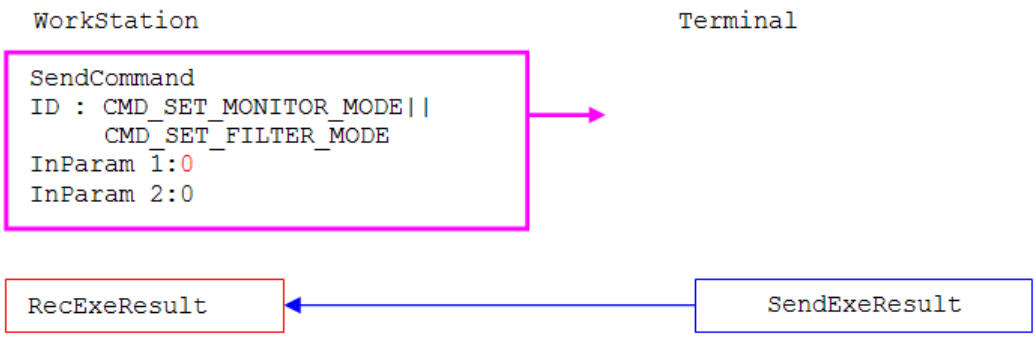

If Setting the CMD_SET_FILTER_MODE Mode，then the filter table should be send in 3 seconds after the command.

Protocol：

COMMAND(External ----Convertor)		
Byte	**Value**	**Meaning**
1	0x55	Always is 0x55
2	0xAA	Always is 0xAA
3 4	1--255, 0 = default	Machine ID
5 6	0	Reserved
7 8	CMD_SET_MONITOR_MODE || CMD_SET_FILTER_MODE	Command ID
9 10 11 12	CMD_SET_MONITOR_MODE：0 CMD_SET_FILTER_MODE：(1～254),the length of filter table.	Input Parameter 1
13 14	0	Input Parameter 2
15 16	ChkSum	Checksum(NOTE 4)
ACK(Convertor ---- External)		
Byte	**Value**	**Meaning**
1	0x5A	Always is 0x5A
2	0xA5	Always is 0xA5
3 4	1--255, 0 = default	Machine ID
5	0x00-NAK	Response

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6	0x01-ACK.	
7 8	ChkSum	Checksum(NOTE 4)
EXERESULT(Convertor ---- External)		
Byte	**Value**	**Meaning**
1	0xAA	Always is 0xAA
2	0x55	Always is 0x55
3 4	1--255, 0 = default	Machine ID
5 6	0	Reserved
7 8	1: OK 0: Error	Result
9 10 11 12	0	Output Parameter
13 14	ChkSum	Checksum(NOTE 4)
Setting Filter Table(External ----Convertor)		
Byte	**Value**	**Meaning**
1	0x5A	Always is 0x5A
2	0xA5	Always is 0xA5
3 4	1--255, 0 = default	Machine ID
	High Byte of the Group Address Low Byte of the Group Address High Byte of the Group Address Low Byte of the Group Address …High Byte …Low Byte …High Byte …Low Byte	Max Data:254*2 Bytes(The Lower Byte of the Group Address follows the higher Byte, and they should be marked in ascending order, e.g., Group Address 00-05 should places before 00-06, also 00-05 should places before 01-05).
19 20	ChkSum	Checksum(NOTE 4)

NOTE：

NOTE 1: According to KNX Standard, it has 4 types, indicates 4 Transmission Priority:

11 = low operational priority

10 = high operational priority

01 = alarm priority

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00 = system priority

Usually we use LOW priority, so the nConfig will be 0x03, others are not recommended.

NOTE 2: The length of the Communication Object which was linked to the DEST ADDR according to the KNX standard, e.g. when the CO lest than 1 byte it equals to 1, otherwise it equals to length + 1.That is to say, when we have a 1 bit CO, then the nLength will be equal to 0x01, while a 1 byte CO will have the nLength of 0x02.

NOTE 3: Destination Group Address which you want to read or write.

NOTE 4: The sum of all the data bytes before.

NOTE 5: The Physical Address of the device from whom sends out the telegram.

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